NEOTROPICAL BIOLOGY AND CONSERVATION

Neotropical Biology and Conservation 21(2): 123–129 (2026)
DOI: 10.3897/neotropical.21.e187967

Short Communication

First photographic evidence of an insular dwarf fox (*Urocyon* sp.) on the island of Cozumel, Mexico

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Abstract

Insular isolation can drive rapid evolutionary divergence, including pronounced dwarfism, in mammals. A dwarfed fox (*Urocyon* sp.) has inhabited the island of Cozumel, Mexico, for millennia, yet prior evidence of its existence was limited to subfossil remains. Additionally, no comprehensive morphological or genetic studies have been conducted, and sightings of the Cozumel fox are exceptionally rare. Here, we report the first photographic record and the first confirmed sighting in over two decades. On 14 September 2023, an adult male was photographed near kilometer 29 on Cozumel's coastal highway. This observation confirms the species' continued presence and highlights its likely critical conservation status. Targeted surveys, population monitoring, and taxonomic assessments are urgently needed, along with habitat protection and measures to minimize human-wildlife conflict, to ensure the survival of this rare and cryptic fox.

Key words: Cozumel fox, insular dwarfism, island conservation, *Urocyon*

OPEN ACCESS

Academic editor: Piter Boll
Received: 8 February 2026
Accepted: 7 April 2026
Published: 4 May 2026

ZooBank: https://zoobank.org/B5FBD9FA-E940-4C9A-BE20-0F4E4C22A26B

Citation: Bayer TD, McGreal MA, Chacón D. AR (2026) First photographic evidence of an insular dwarf fox (*Urocyon* sp.) on the island of Cozumel, Mexico. Neotropical Biology and Conservation 21(2): 123–129. https://doi.org/10.3897/neotropical.21.e187967

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Insular isolation can drive rapid evolutionary divergence and dwarfism in mammals. The genus *Urocyon* currently comprises two extant species: the gray fox (*Urocyon cinereoargenteus*), one of the most widely distributed canids across the Americas (Hall 1981; Fritzell 1987; Eisenberg 1989; de la Rosa and Nocke 2000), and the island fox (*Urocyon littoralis*), which is endemic to six of California's Channel Islands. The island fox represents a well-studied example of insular dwarfism and rapid evolution following isolation (Hofman et al. 2015). Compared to its mainland relatives, it shows clear morphological (Hofman et al. 2015; Young 2020), genetic (Sacks et al. 2022), and ecological differentiation (Hofman et al. 2016). However, archaeological records also reveal that a dwarf fox (*Urocyon* sp.) has inhabited the island of Cozumel, Mexico, for millennia, with evidence suggesting its presence may predate early Mayan settlement (Gompper et al. 2006). Despite their long history of insular isolation, no comprehensive morphological or genetic assessments have ever been conducted on this population. As a result, the evolutionary distinctiveness and conservation status of the Cozumel fox remain poorly understood.

For thousands of years, Cozumel has been home to a small but unique group of carnivores (Hamblin 1984) that all exhibit a reduced body size compared to their mainland relatives (Cuarón et al. 2004). Among these, the pygmy raccoon (*Procyon pygmaeus*) and the dwarf coati (*Nasua nelsoni*) are recognized as distinct endemic species of the island (Merriam 1901; Thomas 1901; McFadden et al. 2008). The island's dwarf fox population (*Urocyon* sp.), however, has never been formally described or designated as taxonomically unique. Sightings of this fox are exceptionally rare and consist of only a few eyewitness accounts and second-hand reports (Merriam 1901; Jones and Lawlor 1965; Cuarón et al. 2004). The most recent dates back to 2001 (Cuarón et al. 2004). The only physical evidence of the species' presence on the island comes from subfossil remains, which indicate pronounced insular dwarfing (a 60–80% reduction in body size), and suggest that isolation began approximately 5,000–37,000 years ago (Hamblin 1984; Gompper et al. 2006).

Here, we report the first photographic evidence of a dwarf gray fox on Cozumel and the first sighting of the animal on the island in over two decades (Fig. 1). In the early morning of 14 September 2023, reports of a disoriented fox began circulating via social media and phone calls to the Fundación de Parques y Museos de Cozumel (FPMC). In response, the senior author, Rafael Chacón, and FPMC conducted a rescue of the animal. At approximately 0600h, an adult male fox was located near the coastal highway at kilometer 29 on the eastern side of the island (20°17.70'N, 86°57.40'W; Fig. 2). The individual was

Figure 1. Image of a dwarf gray fox (*Urocyon* sp.) captured on the island of Cozumel, Mexico. An adult male Cozumel fox (*Urocyon* sp.) is shown partially concealed behind foliage before capture by the Fundación de Parques y Museos de Cozumel (FPMC) on 14 September 2023. This represents the first photograph ever taken of the species on the island and the first reported sighting since 2001. (Photo Credit: Rafael Chacón).

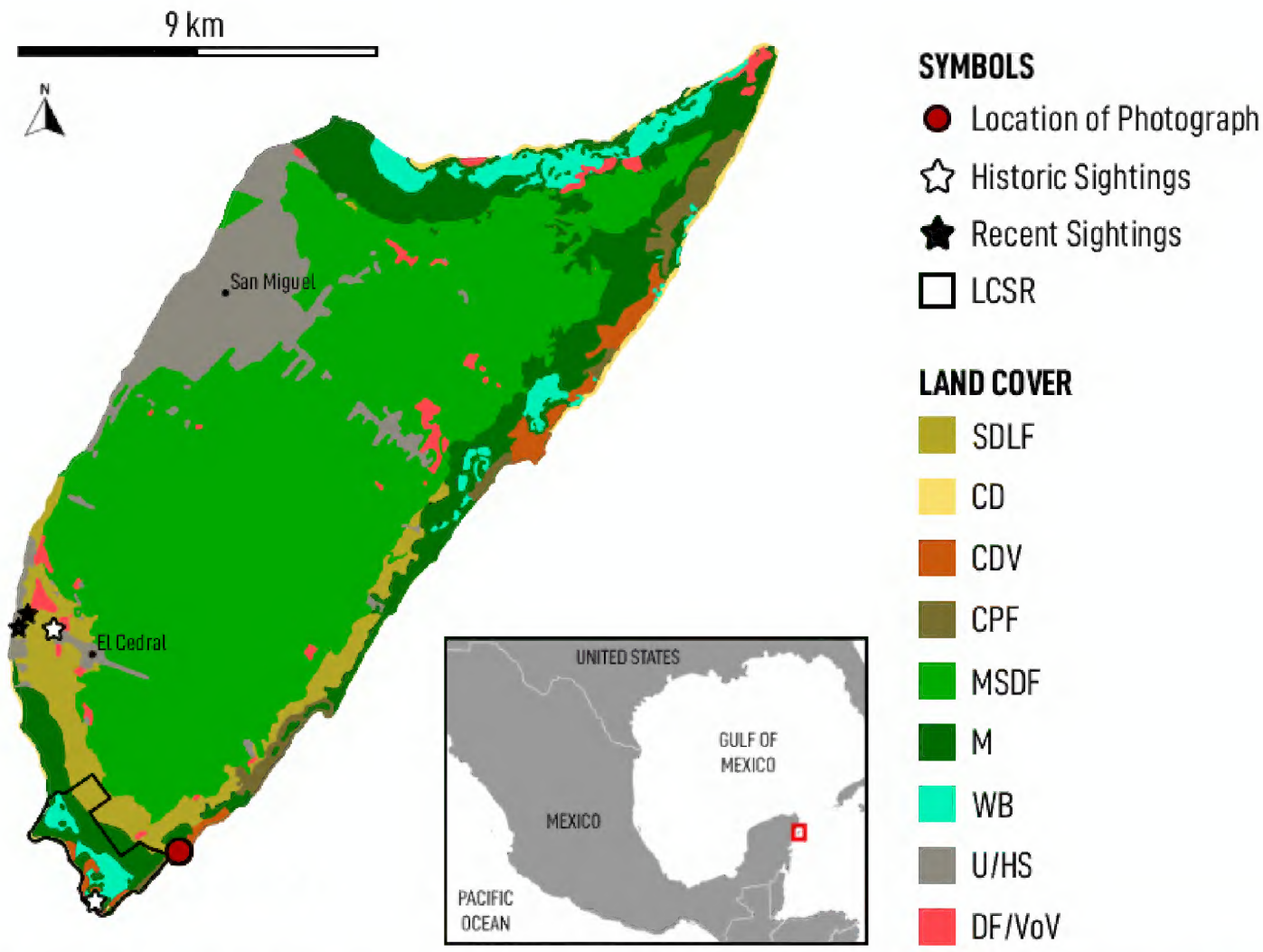

Figure 2. Spatial distribution of dwarf fox records across land use and vegetation types on Cozumel. The red dot outlined in black indicates the location where the fox was photographed in September 2023. White stars denote historical dwarf fox sightings from 1984 and 1985 (Cuarón et al. 2004), and the black stars indicate recent sightings observed by the authors (R. Chacón, unpublished data 2025; Bayer and McGreal, unpublished data 2026). The boundary of the Laguna Colombia State Reserve (LCSR) is outlined in black. The inset map shows the relative location of Cozumel, Mexico. Land-cover categories include SDLF (Subdeciduous Lowland Forest), CD (Coastal Dunes), CDV (Coastal Dune Vegetation), CPF (Chitpalm Forest), MSDF (Medium Subdeciduous Forest), M (Mangroves), WB (Water Bodies), U/HS (Urbanization/Human Settlements), and DF/VoV (Deforestation/Void of Vegetation). Vegetation and land-use data were obtained from the Instituto Nacional de Estadística, Geografía e Informática (INEGI) Land Use and Vegetation Series VIII, adapted from Rodríguez-Luna et al. (2023) and Lara-Godínez et al. (2024).

safely recovered and held under observation for several days (Suppl. material 1: figs S1–S7).

On 17 September 2023, at approximately 0530h, the fox was released into suitable habitat within the Laguna Colombia State Reserve (Fig. 2) following a physical assessment (Fig. 3; see Suppl. material 1 for additional photographs). Selected in coordination with the Procuraduría Federal de Protección al Ambiente (PROFEPA) and the Comisión Nacional de Áreas Naturales Protegidas (CONANP), this location was considered both a safer environment, being farther from the road, and representative of the species' suspected natural habitat on Cozumel.

The Laguna Colombia State Reserve is characterized by a mosaic of tropical lowland forest, seasonal wetlands, and coastal dune vegetation (Fig. 2). The area contains two large brackish lagoons interspersed with vegetation including chit palms, shrubs, mangroves, and lowland forest trees. Forest patches are dominated by native subdeciduous tree species with a dense understory that provides cover and foraging habitat. Scattered grassy areas and open water bodies further increase the Reserve's habitat complexity. Despite their ecolog-

Figure 3. Full-body photograph of adult male Cozumel fox following release in Laguna Colombia State Reserve. The photograph was taken at approximately 0530h on 17 September 2023 following a health assessment and release within the Reserve. Additional images during monitoring and post-release are provided in the Suppl. material 1. (Photo Credit: Rafael Chacón).

ical value, habitats in the southern portion of Cozumel are increasingly threatened by development, land-use change, invasive species, and natural disasters (Borja-Martínez and Vázquez-Domínguez 2024; Cuarón et al. 2004; McFadden 2004; Cuarón et al. 2009; Fuentes-Montemayor et al. 2009; Valenzuela-Galván et al. 2022; Cuarón et al. 2025).

The Cozumel fox has only ever been reported as far north as the community of El Cedral (Fig. 2), suggesting that its distribution may be extremely restricted on the island. Virtually nothing is known about this population, and no species-specific, systematic survey has ever been conducted. However, it is considered critically endangered by scientific consensus and likely on the brink of extinction (Cuarón et al. 2004; McFadden 2004; Gompper et al. 2006; Cuarón et al. 2009; McFadden et al. 2010; Lara-Godínez et al. 2023).

This photographic record confirms the continued presence of the Cozumel fox on the island and emphasizes the urgent need for focused research and conservation attention. Priority actions should include species-specific, targeted surveys to determine its current distribution and population size, as well as morphological and genetic assessments to clarify its taxonomic status. Efforts should focus on the southern end of Cozumel, particularly in and around the Laguna Colombia State Reserve and El Cedral community, which is consistent with both recent and historical sightings of the species. Given its rarity and the

increasing pressure on southern Cozumel, conservation measures to protect the remaining suitable habitat and minimize human-wildlife conflict are warranted. Improved documentation and formal description of this insular fox will be critical for informing effective management, protective policies, and long-term conservation strategies.

Acknowledgements

We want to thank Centro Médico Veterinario de Cozumel (CMVC) for providing veterinary care and ensuring the fox's welfare during rehabilitation before its release. We are also grateful to Humberto Mex of the Procuraduría Federal de Protección al Ambiente (PROFEPA) and Blanca Quiroga of the Comisión Nacional de Áreas Naturales Protegidas (CONANP) for their assistance in coordinating and authorizing the safe release of the animal. We additionally acknowledge the Cozumel Parks and the Fundación de Parques y Museos de Cozumel (FPMC) for their prompt response and logistical support during the recovery and release process. Finally, we thank local citizens whose timely reports helped facilitate the rescue of this fox, and Dr. Teague O'Mara for his guidance and assistance with manuscript review.

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Supplementary material 1

Supplementary figures S1–S7

Authors: AuthorsNames
Data type: pdf
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Link: https://doi.org/10.3897/neotropical.21.e187967.suppl1

Additional information

Conflict of interest

The authors have declared that no competing interests exist.

Ethical statement

No ethical statement was reported.

Artificial Intelligence (AI) use

The authors accept full responsibility for the content of the manuscript, including the disclosure of any use of AI.
No AI tools were used in the preparation of this manuscript.

Funding

No funding was reported.

Author contributions

TDB: conceptualization, methodology, investigation, resources, data curation, visualization, supervision, project administration, writing – original draft, writing – review and editing; MAM: methodology, investigation, resources, writing – review and editing; ARCD: methodology, investigation, resources, data curation, supervision, project administration, validation, writing – review and editing.

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Data availability

All of the data that support the findings of this study are available in the main text or Supplementary Information.